OUR Project A Customizable Pathfinding Module for the Lightning Network

Spring 2025 Project Proposal

Project Title

A Customizable Pathfinding Module for Lightning Network Clients

Project Description

Since its conception in the wake of the global financial crisis in late 2008 by its pseudonymous creator, the Bitcoin cryptocurrency network has gained a considerable amount of traction as the base layer of an alternative financial system with around 20% of American adults as owners. The Lightning network is a scaling solution in which payment channels backed by blockchain transactions allow to overcome any blockchain's inherent throughput limitations and furthermore, instantaneous payments. In order to send a payment within the network, a participant picks one or more suitable payment paths that satisfy their needs. In this project, we design a software package that implements different pathfinding algorithms and underlying modelings to provide customized, user-friendly solutions for pathfinding problems faced by Lightning node operators. The software is meant to interface with as many different popular Lightning node implementations such as Rust-Lightning (https://github.com/lightningdevkit/rust-lightning) (in Rust), LND (https://github.com/lightningnetwork/lnd) (in Go), Core-Lightning (https://github.com/ElementsProject/lightning) (in C) and Eclair (https://github.com/ACINQ/eclair) (in Scala), as possible.

Number of Openings

2

Requirements

A good understanding of the basic design of the Lightning Network by the start of the project is required. Having successfully taken ITCS 4010/5010 Topics in Computer Science - Bitcoin: Programming the Future of Money is highly recommended, but not necessary. A familiarity with shortest-path algorithms (Dijkstra's algorithm, breadth-first search etc.) is also required, as well as the interest to work in at program in at least two of the following programming languages: Rust, Python, C, Go and Eclair.

Preferences

Familiarity or willingness to work with more than two of the programming languages mentioned in "Requirements".

Training

No specific requirements, training takes places during the research project meetings and in discussions with the faculty and graduate student mentor.

Anticipated Student Learning Outcomes

- Familiarization with the inner workings of payments in the Lightning network, which is the currently most popular scaling technology for the Bitcoin network
- Acquiring competence in new programming languages
- Learning about and contributing towards state-of-the-art models and algorithms for payments within the Lightning network
- Contribution to an open-source project with visibility in the communities of Bitcoin and Lightning network developers and start-ups

Mentoring Plan

The student will be guided through the research process in weekly meetings with the mentoring faculty as well as in communication with a Ph.D. student, who serves as a co-mentor. Communication will occur additionally asynchronously through a Slack channel, during which smaller questions can be addressed. If the research project turns out to be successful, mentoring in academic writing and the preparation of research manuscripts will be provided.

Conflicts

Availability on Wednesdays or Thursdays for weekly project meetings with faculty and Ph.D. student mentor.